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Design for a
Street Railway Car Barn

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DESIGN
FOR A
STREET RAILWAY CAR BARN

BY
CARA LOUIS CAMP

THESIS
FOR
DEGREE OF BACHELOR OF SCIENCE
IN
CIVIL ENGINEERING

COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS

PRESENTED JUNE 1905

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May 19, 1905

This is to certify that the thesis prepared under the
immediate supervision of Instructor C. W. Malcolm by


CARA LOUIS CAMP

entitled DESIGN FOR A STREET-RAILWAY CAR BARN

is approved by me as fulfilling this part of the requirements
for the degree of Bachelor of Science in Civil Engineering

Ira C. Baker

Head of Department of Civil Engineering



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DESIGN
FOR A
STREET RAILWAY CAR BARN.

INTRODUCTION.

In the spring of 1904 it was proposed by the Springfield Consolidated Railway Company, of Springfield, Illinois, to build a combined car barn and office building. An old power station was remodeled, however, and is now used for that purpose. The building is near the business portion of the city, and would yield a greater income if put to some other use; while a car barn farther out would be of as much value to the Company, and would cost less to maintain. In consideration of these facts, the writer has chosen the design of such a structure for his thesis.

This thesis will consist of a general description of the building, an estimate of the cost, and the following drawings:-

- (1) Stress Sheet for Roof Truss,

- (2) Details of Roof Truss,
- (3) Plans and Elevations.

The steel work will be designed according to the specifications in Ketchum's "Steel Mill Buildings." Cambria's Hand-book will be used for the properties of all sections.

DESCRIPTION.

The building will be of brick, 92 ft. by 306 ft. outside dimensions, and will be covered with a four-ply felt and gravel roof. It will be divided into three sections, the barn proper, the shops and storeroom, and the offices.

The barn proper will be 76 ft. by 306 ft. The walls will be 8 inches thick and 18 ft. high, and will support steel roof-trusses by pilasters 18 inches square. These pilasters will be 16 ft. center to center and 16 ft. high. The roof trusses will be of the Fink type, with a span of 75 ft., and a pitch of $\frac{1}{4}$. The front of the barn will contain six double doors 16 ft. by 10 ft., the wall above resting on two 7-inch I beams supported by brick piers two ft. square. The barn will contain six par-

allel tracks, 12 ft. center to center, running lengthwise of the building

The shops and store-room will be 16 ft. by 225 ft. with 8-inch walls, and will be built at the side of the barn as shown in Drawing Number 3. This section will contain the storeroom, the sand room, and the shops.

The section containing the offices will be two stories high, 16 ft. by 81 ft., the first story to be twelve ft. high, the second 10 ft., with walls 12 inches and 8 inches, respectively. The first floor will contain the general offices, and the second will be occupied by the employees.

ESTIMATE OF COST.

An estimate of the cost of the building will be made to accompany the design. All estimates for steel work will be made according to data given in Ketchum's "Steel Mill Buildings." Estimates for all other work will be made on prices quoted by Prof. J. M. White, of the Department of Architecture. The brick work will be estimated according to the "Rules of Measurement" adopted by the Chicago Masons and Builders Association.

ESTIMATE OF WEIGHT.

No. of Pieces.	Shape.	Section.	Length.		Wt. lb. per ft.	Weight		Details % of Main Members	Total Weight.
			Ft.	In.		Main Members	Details		
18	Trusses each		thus						
4	LS	5"x3"x $\frac{3}{8}$ "	41	11 $\frac{1}{2}$	9.8	1644			
4	LS	3 $\frac{1}{2}$ "x3 $\frac{1}{2}$ "x $\frac{7}{16}$ "	23	11 $\frac{3}{4}$	9.8	940			
4	LS	3"x3"x $\frac{1}{4}$ "	27	0 $\frac{1}{2}$	4.9	530			
8	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	2	1 $\frac{1}{4}$	3.7	63			
16	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	4	11 $\frac{1}{2}$	3.7	294			
8	LS	3 $\frac{1}{2}$ "x2 $\frac{1}{2}$ "x $\frac{1}{4}$ "	9	11 $\frac{1}{2}$	4.9	390			
8	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	10	9	3.7	318			
4	LS	3"x3"x $\frac{1}{4}$ "	22	6	4.9	351			
1	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	18	0	3.7	67			
4	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	5	3	3.7	122			
2	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	4	5	3.7	33			
1	L	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	3	11	3.7	15			
4	LS	2 $\frac{1}{2}$ "x2"x $\frac{1}{4}$ "	4	8 $\frac{1}{4}$	3.7	91			
2	Plates	27"x $\frac{3}{8}$ "	1	8 $\frac{1}{2}$	34.44		72		
7	"	6"x $\frac{3}{8}$ "	0	10 $\frac{1}{2}$	7.65		47		
4	"	12"x $\frac{3}{8}$ "	1	9 $\frac{1}{2}$	15.30		107		
2	"	17"x $\frac{3}{8}$ "	2	11	21.68		127		
1	"	25 $\frac{1}{2}$ "x $\frac{3}{8}$ "	4	1	32.52		133		
4	"	8"x $\frac{3}{8}$ "	0	9	10.20		31		

ESTIMATE OF WEIGHT. (Concl.).

No. of Pieces	Shape	Section.	Length		Wt. lb. per ft.	Weight		Details % of Main Members	Total Weight.
			Ft.	In.		Main Members	Details		
2	Plates	7" x $\frac{3}{8}$ "	0	11 $\frac{1}{2}$	8.93		9		
2	"	14" x $\frac{3}{8}$ "	1	5 $\frac{1}{2}$	17.86		53		
2	"	17" x $\frac{3}{8}$ "	2	7	21.68		112		
2	"	11 $\frac{1}{2}$ " x $\frac{3}{8}$ "	1	0 $\frac{1}{2}$	14.68		29		
2	"	9" x $\frac{3}{8}$ "	0	8	11.48		15		
2	"	18" x $\frac{3}{8}$ "	0	8	22.95		30		
2	"	10" x $\frac{3}{8}$ "	0	10	12.75		21		
1	"	8 $\frac{1}{2}$ " x $\frac{3}{8}$ "	0	11	10.84		10		
1	"	12" x $\frac{3}{8}$ "	1	0	15.30		15		
460		$\frac{5}{8}$ " Rivet Heads			9.95	per 100	46		
Total			1 Truss		4858		857	17.2	5715
			" 18 Trusses						102870
PURLINS.									
380	LS	6"	16	0	1225	74480			
360	L	5" x 3 $\frac{1}{2}$ " x $\frac{3}{8}$ "	0	10 $\frac{3}{8}$	9.8		3159	4.2	77639
CRANE GIRDER.									
38	Is	8"	16	0	18	10944			10944
BOTTOM CHORD STIFFENERS.									
34	LS	3 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " x $\frac{1}{4}$ "	16	0	4.9	2665			2665
Total Steel Work						175523	18585	15.9	194118

ESTIMATE OF COST OF STEEL WORK.

Classification of Material.	Weight lb.	Cost of Material.		Cost of Labor	
		Price	Amount	Price	Amount
Riveted Trusses	102870	¢ 1.6	\$ 1645.92	¢ 1.00	1028.70
I Beam Girders	10944	1.65	180.58	.25	26.86
L Bracing	2665	1.6	42.64	.25	6.66
[Purlins	77639	1.6	1242.22	.15	116.45
Totals.	194118		3111.36		1178.67

SUMMARY.

Cost of Material		\$ 3111.36
Cost of Shop Labor		1178.67
Cost of Details	87 T. @ \$3.60	313.20
Cost of Shop Painting		116.00
Total Shop Cost		4719.23
Freight, Mill to Shop	87 T. @ 4.40	382.80
Freight, Shop to Site	87 T. @ 1.00	87.00
Erection, Structural	87 T. @ 8.00	696.00
Painting		60.00
Total Cost of Steel Work		5945.03

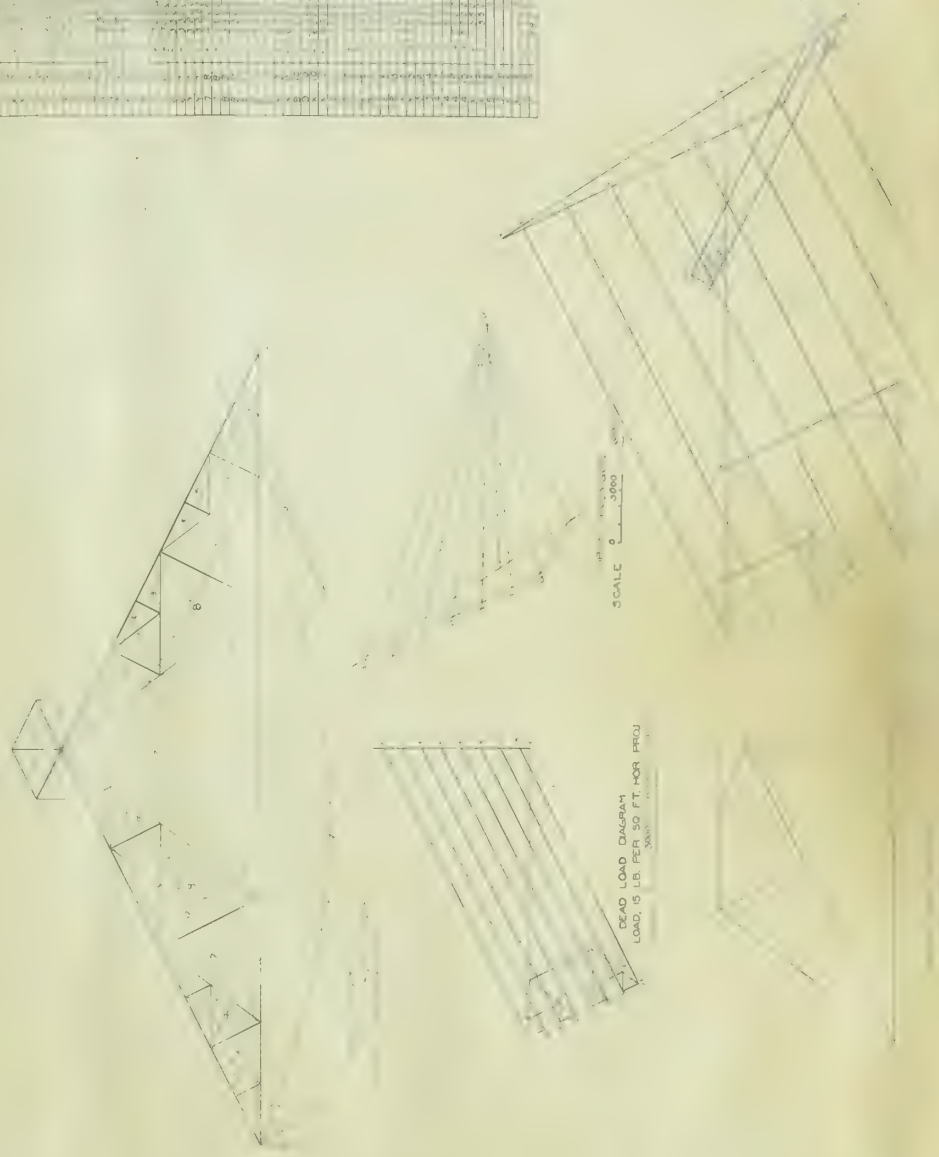
ESTIMATE OF COST OF BUILDING.

Ref No.	Kind of Work.	Amount	Unit Price	Total Cost.
1	Steel Work	See page 7		\$ 5945.
2	Brick Walls	494300 Brk	\$ 10.50 per M.	5189.
3	Brick Floors	101300 "	10.50 " M.	1064
4	Composition Roof	30600 sq. ft.	.04 " sq. ft.	1224
5	Rafters and Sheathing	30600 " "	.06 " " "	1836.
6	Wooden Floors	6176 " "	.12 " " "	741.
7	Partitions	1536 " "	.025 " " "	39.
8	Windows	5095 " "	.75 " " "	3821.
9	Doors	1632 " "	.75 " " "	1224.
10	Plastering.	893 " yd.	.25 " " yd.	224.
11	Copper	3600 " ft.	.40 " " ft.	1440.
12	Stairway			50
13	Base Board	576 ft.	.10 per ft.	58
14			Total	23855
14.	Miscellaneous	15% total	cost.	3428
	Cost of Building			26283.

Member	Dead Load	Live Load	Wind Load	Max. Stress	Min. Stress
1	1000	1000	1000	1000	1000
2	1000	1000	1000	1000	1000
3	1000	1000	1000	1000	1000
4	1000	1000	1000	1000	1000
5	1000	1000	1000	1000	1000
6	1000	1000	1000	1000	1000
7	1000	1000	1000	1000	1000
8	1000	1000	1000	1000	1000
9	1000	1000	1000	1000	1000
10	1000	1000	1000	1000	1000
11	1000	1000	1000	1000	1000
12	1000	1000	1000	1000	1000
13	1000	1000	1000	1000	1000
14	1000	1000	1000	1000	1000
15	1000	1000	1000	1000	1000
16	1000	1000	1000	1000	1000
17	1000	1000	1000	1000	1000
18	1000	1000	1000	1000	1000
19	1000	1000	1000	1000	1000
20	1000	1000	1000	1000	1000
21	1000	1000	1000	1000	1000
22	1000	1000	1000	1000	1000
23	1000	1000	1000	1000	1000
24	1000	1000	1000	1000	1000
25	1000	1000	1000	1000	1000
26	1000	1000	1000	1000	1000
27	1000	1000	1000	1000	1000
28	1000	1000	1000	1000	1000
29	1000	1000	1000	1000	1000
30	1000	1000	1000	1000	1000
31	1000	1000	1000	1000	1000
32	1000	1000	1000	1000	1000
33	1000	1000	1000	1000	1000
34	1000	1000	1000	1000	1000
35	1000	1000	1000	1000	1000
36	1000	1000	1000	1000	1000
37	1000	1000	1000	1000	1000
38	1000	1000	1000	1000	1000
39	1000	1000	1000	1000	1000
40	1000	1000	1000	1000	1000
41	1000	1000	1000	1000	1000
42	1000	1000	1000	1000	1000
43	1000	1000	1000	1000	1000
44	1000	1000	1000	1000	1000
45	1000	1000	1000	1000	1000
46	1000	1000	1000	1000	1000
47	1000	1000	1000	1000	1000
48	1000	1000	1000	1000	1000
49	1000	1000	1000	1000	1000
50	1000	1000	1000	1000	1000
51	1000	1000	1000	1000	1000
52	1000	1000	1000	1000	1000
53	1000	1000	1000	1000	1000
54	1000	1000	1000	1000	1000
55	1000	1000	1000	1000	1000
56	1000	1000	1000	1000	1000
57	1000	1000	1000	1000	1000
58	1000	1000	1000	1000	1000
59	1000	1000	1000	1000	1000
60	1000	1000	1000	1000	1000
61	1000	1000	1000	1000	1000
62	1000	1000	1000	1000	1000
63	1000	1000	1000	1000	1000
64	1000	1000	1000	1000	1000
65	1000	1000	1000	1000	1000
66	1000	1000	1000	1000	1000
67	1000	1000	1000	1000	1000
68	1000	1000	1000	1000	1000
69	1000	1000	1000	1000	1000
70	1000	1000	1000	1000	1000
71	1000	1000	1000	1000	1000
72	1000	1000	1000	1000	1000
73	1000	1000	1000	1000	1000
74	1000	1000	1000	1000	1000
75	1000	1000	1000	1000	1000
76	1000	1000	1000	1000	1000
77	1000	1000	1000	1000	1000
78	1000	1000	1000	1000	1000
79	1000	1000	1000	1000	1000
80	1000	1000	1000	1000	1000
81	1000	1000	1000	1000	1000
82	1000	1000	1000	1000	1000
83	1000	1000	1000	1000	1000
84	1000	1000	1000	1000	1000
85	1000	1000	1000	1000	1000
86	1000	1000	1000	1000	1000
87	1000	1000	1000	1000	1000
88	1000	1000	1000	1000	1000
89	1000	1000	1000	1000	1000
90	1000	1000	1000	1000	1000
91	1000	1000	1000	1000	1000
92	1000	1000	1000	1000	1000
93	1000	1000	1000	1000	1000
94	1000	1000	1000	1000	1000
95	1000	1000	1000	1000	1000
96	1000	1000	1000	1000	1000
97	1000	1000	1000	1000	1000
98	1000	1000	1000	1000	1000
99	1000	1000	1000	1000	1000
100	1000	1000	1000	1000	1000

DESIGN OF CAR BARN STRESS SHEET FOR ROOF

G. R. Camp
UNIVERSITY OF ILLINOIS, URBANA
SHEET 2 OF 3

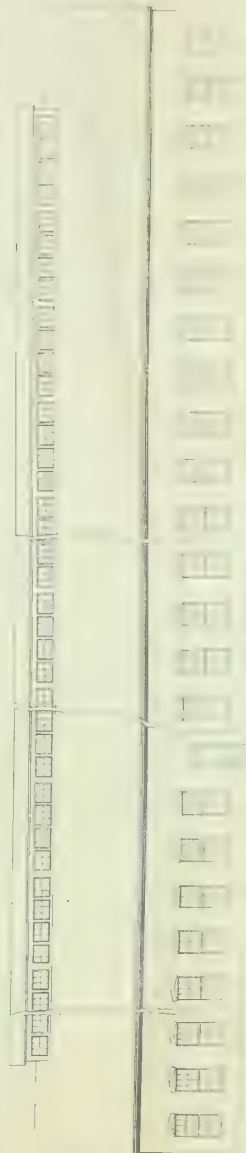


DEAD LOAD DIAGRAM
LOAD, 15 LB. PER SQ. FT. FOR ROOF

SCALE 0 3000



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SCALE 0 217 1000
SHEETS 3 SHEETS







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